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ABSTRACT

This is the student guide in a set of five computer-oriented environmental/energy education units. Contents of this guide are: (1) Introduction to the unit; (2) The "EARTH" program; (3) Exercises; and (4) Sources of information on the energy crisis. This guide supplements a simulation which allows students to analyze different aspects of energy conditions existing around the world. (MR)

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TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC) AND USERS OF THE ERIC SYSTEM."

SE 026 735

This edition is based on earlier developmental work conducted with a limited test sample. The material was reviewed in order to correct any noted technical errors prior to printing of the October 1977 edition. However, purchasers are urged to first run the sample simulation program provided in order to determine any needed or desired adjustments prior to actual use. The Laboratory would appreciate hearing from users concerning any suggestions for corrections to subsequent editions.

First Printing, October 1977

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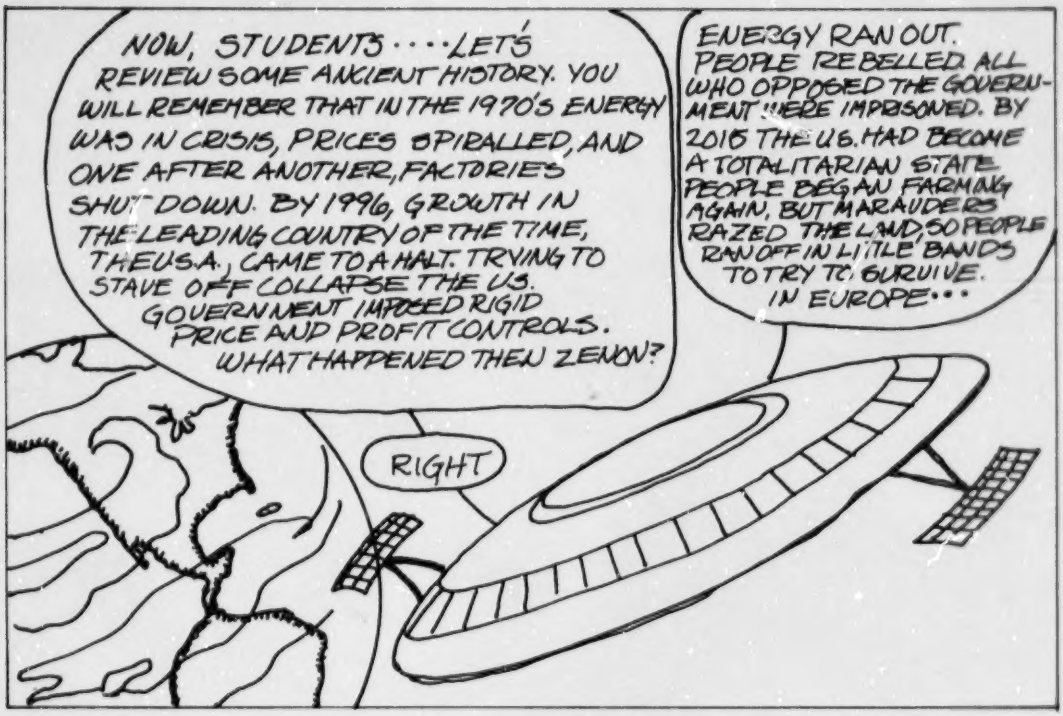
INTRODUCTION TO THE UNIT

The Earth and Energy


NOW, STUDENTS····LET'S REVIEW SOME ANCIENT HISTORY. YOU WILL REMEMBER THAT IN THE 1970'S ENERGY WAS IN CRISIS, PRICES SPIRALLED, AND ONE AFTER ANOTHER, FACTORIES SHUT DOWN. BY 1996, GROWTH IN THE LEADING COUNTRY OF THE TIME, THE U.S.A., CAME TO A HALT. TRYING TO STAVE OFF COLLAPSE THE U.S. GOVERNMENT IMPOSED RIGID PRICE AND PROFIT CONTROLS. WHAT HAPPENED THEN ZENON?
ENERGY RAN OUT. PEOPLE REBELLED. ALL WHO OPPOSED THE GOVERNMENT WERE IMPRISONED. BY 2015 THE U.S. HAD BECOME A TOTALITARIAN STATE. PEOPLE BEGAN FARMING AGAIN, BUT MARAUDERS RAZED THE LAND, SO PEOPLE RAN OFF IN LITTLE BANDS TO TRY TO SURVIVE. IN EUROPE···
RIGHT

The history of human development is, in many ways, the history of peoples' ability to harness energy. The types of energy we use, and how we use them are basic factors in determining how we live. Think of how different your life would be if suddenly the only energy source available to you was your own muscle power. As the above cartoon suggests, the results could be disastrous. If you survived at all, you would probably be sitting in a cave without so much as a fire to provide heat and light. Since few people would find that a pleasant way to live, the Earth's energy resources and how we use them are important to us now, and to people of the future.

It takes a tremendous amount of energy to maintain our life style--and our needs for energy grow each year. In the United States, we will use more energy in the next 30 years than we have in the entire history of our Nation. By the year 2001 our country's energy needs will have probably doubled, and world wide demands are expected to triple. That's a lot of energy! As our energy demands increase, so do the problems we face regarding energy use. Are there enough energy reserves to meet the increasing demands? Will we have the means to convert energy reserves into useful work and heat? How do we divide up the Earth's reserves of coal, oil and natural gas? The U.S.,

with 6% of the world population, currently uses about a third of the energy produced each year. The newly emerging nations of the world require increasingly greater proportions of energy resources. How will the nations of the world deal with these demands?

Another area of increasing concern is the effect of high energy production and consumption on our environment. One of the largest producers of oil is the country of Kuwait. Kuwait is estimated to have one-fourth of the world's total oil reserves. But Kuwait's oil contains hugh amounts of sulfur--a major air pollutant. In the U.S. the most abundant fuel is coal. But coal is the dirtiest fuel to use. In addition to this, the process used to extract half of the coal we use--strip mining--destroys the Earth's surface. How do we reach a workable balance between energy use and environmental concerns? How we solve these and other problems regarding energy use will have far reaching effects on our lives and the lives of future generations. If our decisions are wise it will mean a better quality of life for all peoples.

This unit of study is designed to help you become more informed about the energy conditions around our globe. By using this booklet and the computer program EARTH, you should gain a useful understanding of the world's current energy situations. You will also have the opportunity to examine your values regarding energy problems.

What This Unit Will Do For You

You will have a chance to examine many energy-relevant variables in 83 modern countries and to analyze different aspects of the energy conditions existing around the globe. Studying these conditions will give you a clear perspective on the global dimensions of the energy shortage.

Using the computer program EARTH in a variety of ways, you will have the chance to formulate and test hypotheses about the energy situation on a worldwide basis.

This study will also give you the opportunity to examine your own values regarding energy problems; some of your ideas may change as the result of your study of energy conditions around the world.

THE 'EARTH' PROGRAM

Description

So that you can explore questions and hypotheses relating to energy use on a global basis, a collection of data (called a "data base") has been stored in the computer. The data is organized by country, for the 83 largest countries in the world. For each country, data on 24 variables has been stored. These variables are listed on page 5. The 83 countries are listed on page 6.

Given this data base, you can ask the computer for subsets of data to help you answer questions or explore ideas. You may want to see something as simple as "1971 population for the USA." (That's one variable for one country.) Or, you may wish to look at two variables for three countries--for example, "1971 energy production (71 EN PRO)" and "1971 energy consumption (71 EN CON)" for Japan, the USA, and the USSR. These two tables are shown below as the computer would print them out.

	VARIABLE	
COUNTRY	71 EN PRO	71 EN CON
JAPAN	49.47	341.9
U.S.A.	2029.19	2327.64
U.S.S.R.	1250.26	1112.19

	VARIABLE
COUNTRY	71 DENS.
U.S.A.	22

As you can see, a table showing several variables for several countries can be useful in making comparisons. Are any of the three countries (Japan, USA or USSR) "energy independent"--that is, producing as much or more energy than is consumed?

To obtain such tables which can show data on up to five variables at a time and up to 83 countries at a time, use the "Table" option of the EARTH program. That is, when the computer asks "WHICH OPTIONS?", enter a "T."

EARTH also offers another option which you may wish to use. This is the RANK option (or "R"). This option will allow you to choose a single variable, such as "daily calorie consumption per capita," and obtain a rank order list from largest value to smallest value for all countries. Or, you can ask for the "top ten" from that list, or the "bottom eight"--or, any number of countries you wish from the top or the bottom of the list.

Three other options offered by EARTH are utility options. One, the "LIST" option, allows you to get a printed list of either the 24 variables or the 83 countries for which data is stored. A "HELP" option is included which can be used to get a listing of all options. Finally, the "STOP" option allows you to stop the program at any time the question "WHICH OPTION?" is asked.

List of Variables Stored for Each Country

Variable Number	Data *
1	1971 population in millions
2	1971 population density per square kilometer
3	1963-1971 population increase rate, in %
4	Male life expectancy
5	Female life expectancy
6	Daily calorie consumption per capita
7	1968 national income in millions of dollars
8	1971 national income in millions of dollars
9	**1968 energy production in million metric tons of coal equivalent
10	1971 energy production in million metric tons of coal equivalent
11	1968 energy consumption in million metric tons of coal equivalent
12	1971 energy consumption in million metric tons of coal equivalent
13	1968 energy consumption per capita in kilograms
14	1971 energy consumption per capita in kilograms
15	Coal reserves in million metric tons
16	1972 Coal production in thousand metric tons
17	***Reserves of lignite and brown coal in million metric tons
18	1972 production of lignite and brown coal in thousand metric tons
19	Petroleum reserves in million metric tons
20	1972 production of petroleum in thousand metric tons
21	Natural gas reserves in thousand million cubic meters
22	1972 production of natural gas in million cubic meters
23	1971 production of electrical energy in million kilowatt hours
24	1971 production of manufactured gas in million cubic meters

* All data provided are estimates.

** A metric ton is 1000 kilograms; it is about 2200 pounds, 10% larger than the "American" ton

*** Lignite and brown coal are similar to common coal except that they provide less energy per unit of weight and they usually contain more moisture.

List of Countries for Which Data is Stored

1. Afghanistan
2. Algeria
3. Argentina
4. Australia
5. Austria
6. Belgium
7. Bolivia
8. Brazil
9. Bulgaria
10. Burundi
11. Canada
12. Chad
13. Chile
14. China
15. Colombia
16. Cuba
17. Czechoslovakia
18. Denmark
19. Dominican Republic
20. Ecuador
21. Egypt
22. El Salvador
23. Ethiopia
24. Finland
25. France
26. Germany
27. Ghana
28. Greece
29. Guatemala
30. Guinea
31. Haiti
32. Hong Kong
33. Hungary
34. India
35. Indonesia
36. Iran
37. Iraq
38. Israel
39. Italy
40. Ivory Coast
41. Japan
42. Kenya
43. Korea
44. Laos
45. Malaysia (West)
46. Mali
47. Mexico
48. Morocco
49. Netherlands
50. Nepal
51. Niger
52. Nigeria
53. Norway
54. Pakistan
55. Peru
56. Philippines
57. Poland
58. Portugal
59. Romania
60. Rwanda
61. Saudi Arabia
62. Senegal
63. South Africa
64. Southern Rhodesia
65. Spain
66. Sri Lanka
67. Sudan
68. Sweden
69. Switzerland
70. Syrian Arab Republic
71. Thailand
72. Turkey
73. Uganda
74. United Kingdom
75. United Republic of Tanzania
76. USA
77. USSR
78. Upper Volta
79. Viet Nam
80. Yemen
81. Yugoslavia
82. Zaire
83. Zambia

How to Run the EARTH Program

First, be sure your teacher has loaded the necessary programs and files (see the Teacher's Manual, "How to Load the Earth Program").

Type

GET-EARTH (R)

RUN (R)

You will then be asked

WANT INSTRUCTIONS (YES OR NO)?

Type YES (R) if this is your first time

You will then be asked

WHICH OPTION?

At this point you may choose one of five options: TABLE, LIST, RANK, HELP or STOP. You will probably want to choose TABLE or RANK. You may type the whole word, or simply enter a "T" or an "R." Always strike the carriage return key (R) when you are finished.

The TABLE option will allow you to specify the specifics of the table you want printed. Decide upon up to five variables from the list on page 5. Also decide for which countries you want data on these variables. (See the list of countries on page 6.)

The computer will ask you

HOW MANY COUNTRIES?

Enter the total number of countries you want--or enter 83 to get a table for all countries in the data base.

Unless you entered "83," the computer will now print a series of question marks. After each one, type a number for one of the countries you selected. Enter these numbers one at a time in consecutive order, one number after each question mark. Look at the sample run in the next section to see how this is done.

Next, the computer will ask you

HOW MANY VARIABLES?

Enter the total number of variables you want, up to 5. If you are interested in more than 5 variables, you will have to use the TABLE option more than once. For now, enter a number from 1 to 5.

The computer will again print question marks. After each question mark, enter a number for one of the variables you selected. Again, enter only one number after each question mark, in consecutive order.

The computer will then print your table.

The RANK option will allow you to specify one variable from the list, and the computer will rank order all 83 countries, from highest to lowest, for that variable.

You will then be asked

ALL COUNTRIES (YES OR NO)?

If you want to see the rank order list for all countries, type YES (or "Y"). If not, type NO (or "N").

If you typed NO, you will be asked

HOW MANY?

Enter the number of countries you wish to see, for example, 10. Then, you'll be asked

TOP OR BOTTOM?

If you want to see the top 10 countries from the rank order list, type TOP (or "T"). If you want to see the 10 countries at the bottom of the list, type BOTTOM (or "B").

The computer will then print the rank order list, or the top or bottom countries on the list, as you specified.*

* Note: For some countries, there is no readily available information for some variables. For these values, a zero has been entered in the data base, and these countries are omitted from the rank order list.

Sample Run

Here is a sample run showing how one student interacted with the EARTH program. Everything typed by the student is underlined in black.

```
GET-EARTH
RUN
EARTH

WANT INSTRUCTIONS (YES OR NO)?YES


THE 'EARTH' PROGRAM OFFERS 5 OPTIONS.  THEY ARE--

     TABLE:  THE COMPUTER WILL PRINT A TABLE SHOWING THE
VALUES OF UP TO 5 VARIABLES FOR UP TO 83 COUNTRIES.
FIND THE LIST OF VARIABLES AND THE LIST OF COUNTRIES IN
YOUR MANUAL (PP. 5  AND 6 ) OR USE THE 'LIST' OPTION.
THESE LISTS GIVE YOU THE CODE NUMBER YOU SHOULD ENTER
FOR EACH VARIABLE AND EACH COUNTRY.

     LIST:  THE COMPUTER WILL PRINT A LIST OF ALL VARIABLES
OR ALL COUNTRIES IN THE FILE.

     RANK:  THE COMPUTER WILL RANK THE VALUES FOR A GIVEN VARIABLE
AND PRINT THOSE VALUES IN RANK ORDER FROM HIGHEST TO LOWEST.
YOU CAN ASK FOR THESE VALUES FOR ALL COUNTRIES, OR YOU CAN
SPECIFY A NUMBER OF COUNTRIES FROM THE TOP OR BOTTOM OF THE LIST.
COUNTRIES FOR WHICH NO INFORMATION IS AVAILABLE WILL BE OMITTED.

     HELP:  THE COMPUTER WILL PRINT THIS LIST OF OPTIONS AGAIN.

     STOP:  TO END THE PROGRAM, TYPE 'STOP'.


WHICH OPTION?LIST
LIST COUNTRIES OR VARIABLES?COUNTRIES

 1     AFGHANISTAN
 2     ALGERIA
 3     ARGENTINA
 4     AUSTRALIA
 5     AUSTRIA
 6     BELGIUM
 7     BOLIVIA
 8     BRAZIL
 9     BULGARIA
 10    BURUNDI
 11    CANADA
 12    CHAD
 13    CHILE
```

14	CHINA
15	COLOMBIA
16	CUBA
17	CZECHOSLOVAKIA
18	DENMARK
19	DOMINICAN REPUBLIC
20	ECUADOR
21	EGYPT
22	EL SALVADOR
23	ETHIOPIA
24	FINLAND
25	FRANCE
26	GERMANY
27	GHANA
28	GREECE
29	GUATEMALA
30	GUINEA
31	HAITI
32	HONG KONG
33	HUNGARY
34	INDIA
35	INDONESIA
36	IRAN
37	IRAQ
38	ISRAEL
39	ITALY
40	IVORY COAST
41	JAPAN
42	KENYA
43	KOREA
44	LAOS
45	WEST MALAYSIA
46	MALI
47	MEXICO
48	MOROCCO
49	NETHERLANDS
50	NEPAL
51	NIGER
52	NIGERIA
53	NORWAY
54	PAKISTAN
55	PERU
56	PHILLIPINES
57	POLAND
58	PORTUGAL
59	ROMANIA
60	RWANDA
61	SAUDI ARABIA
62	SENEGAL
63	SOUTH AFRICA
64	SOUTHERN RHODESIA
65	SPAIN
66	SRI LANKA
67	SUDAN
68	SWEDEN
69	SWITZERLAND
70	SYRIAN ARAB REPUBLIC

```
 71    THAILAND
 72    TURKEY
 73    UGANDA
 74    UNITED KINGDOLM
 75    UN. REP. OF TANZANIA
 76    U.S.A.
 77    U.S.S.R.
 78    UPPER VOLTA
 79    VIET NAM
 80    YEMEN
 81    YUGOSLAVIA
 82    ZAIRE
 83    ZAMBIA


WHICH OPTION?
CHOOSE ONE OF THESE OPTIONS:
   TABLE
   LIST
   HELP
   STOP



WHICH OPTION?LIST
LIST COUNTRIES OR VARIABLES?VARIABLES

 1     1971 POPULATION IN MILLIONS
 2     1971 POPULATION DENSITY/SQ. KM.
 3     1963-1971 POPULATION INCREASE (%)
 4     MALE LIFE EXPECTANCY
 5     FEMALE LIFE EXPECTANCY
 6     CALORIE CONSUMPTION PER DAY PER CAPITA
 7     1968 NATIONAL INCOME (MILLIONS OF $$)
 8     1971 NATIONAL INCOME (MILLIONS OF $$)
 9     1968 ENERGY PRODUCED (M.M.T.C.E.)
 10    1971 ENERGY PRODUCED (M.M.T.C.E.)
 11    1968 ENERGY CONSUMED (M.M.T.C.E.)
 12    1971 ENERGY CONSUMED (M.M.T.C.E.)
 13    1968 ENERGY CONSUMED PER CAPITA (KG.)
 14    1971 ENERGY CONSUMED PER CAPITA (KG.)
 15    COAL RESERVES (M.M.T.)
 16    1972 COAL PRODUCED (T.M.T.)
 17    LIGNITE & BROWN COAL RESERVES (M.M.T.)
 18    1972 LIGNITE & BROWN COAL PRODUCED (T.M.T.)
 19    1972 PETROLEUM RESERVES (M.M.T.)
 20    1972 PETROLEUM PRODUCED (T.M.T.)
 21    1972 NATURAL GAS RESERVES (1000 M.C.M.)
 22    1972 NATURAL GAS PRODUCED (M.C.M.)
 23    1971 ELECTRICAL ENERGY PRODUCED (M.KWH.)
 24    1971 MANUFACTURED GAS PRODUCED (M.C.M.)

FOR MEANING OF ABBREVIATIONS, SEE YOUR MANUAL.
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```
WHICH OPTION?T

HOW MANY COUNTRIES?8

AFTER EACH '?' TYPE A NUMBER FROM THE LIST OF COUNTRIES.
OR. TYPE '0' TO SEE THE LIST.

?11
?14
?16
?21
?26
?41
?76
?77

HOW MANY VARIABLES (5 OR LESS. PLEASE)?3

AFTER EACH '?' TYPE A NUMBER FROM THE LIST OF VARIABLES.
OR. TYPE '0' TO SEE THE LIST.

?1
?7
?12
FOR COUNTRIES 11    14    16    21    26    41    76    77
AND VARIABLES 1     7     12

                VARIABLE

COUNTRY         71 POP.       68 INCOME     71 EN CON

CANADA           21.595         58979.        201.38
CHINA            787.176        0             0
CUBA             8.657          0             9.97
EGYPT            34.13          5986          9.69
GERMANY          75.129         0             320.06
JAPAN            104.661        0             341.9
U.S.A.           207.05         782035.       2327.64
U.S.S.R.         245.091        0             1112.19
```

```
WHICH OPTION?TABLE

HOW MANY COUNTRIES?83

HOW MANY VARIABLES (5 OR LESS, PLEASE)?1

AFTER EACH '?' TYPE A NUMBER FROM THE LIST OF VARIABLES.
OR, TYPE '0' TO SEE THE LIST.

?6

FOR ALL COUNTRIES

AND VARIABLES 6

                VARIABLE

COUNTRY         CAL. CONS


AFGHAN'STAN     2060
ALGERIA         1890
ARGENTINA       3160
AUSTRALIA       3160
AUSTRIA         3230
BELGIUM         3230
BOLIVIA         1760
BRAZIL          2820
BULGARIA        3070
BURUNDI         2330
CANADA          3200
CHAD            2240
CHILE           2560
CHINA           2050
COLOMBIA        2140
CUBA            2500
CZECHOSLOV.     3030
DENMARK         3250
DOM. REPUB.     2060
ECUADOR         1970
EGYPT           2770
EL SALVADOR     1850
ETHIOPIA        1980
FINLAND         2940
FRANCE          3270
GERMANY         3180
GHANA           2070
GREECE          2900
GUATEMALA       2020
GUINEA          2060
HAITI           1930
```

HONG KONG	2370
HUNGARY	3190
INDIA	1990
INDONESIA	1920
IRAN	2030
IRAQ	2050
ISRAEL	2990
ITALY	3020
IVORY COAST	2430
JAPAN	2470
KENYA	2200
KOREA	2270
LAOS	2040
W. MALAYSHA	2190
MALI	2130
MEXICO	2620
MOROCCO	2130
NETHERLANDS	3200
NEPAL	2030
NIGER	2170
NIGERIA	2290
NORWAY	2940
PAKISTAN	2410
PERU	2260
PHILLIPINES	2040
POLAND	3140
PORTUGAL	2920
ROMANIA	3010
RWANDA	1900
SA. ARABIA	2080
SENEGAL	2300
SO. AFRICA	2730
S. RHODESIA	2550
SPAIN	2770
SRI LANKA	2340
SUDAN	2090
SWEDEN	2850
SWITZERLAND	3190
SY ARAB REP	2450
THAILAND	2210
TURKEY	2760
UGANDA	2160
UN. KINGDOM	3170
TANZANIA	1700
U.S.A.	3300
U.S.S.R.	3180
UPPER VOLTA	2060
VIET NAM	2000
YEMEN	2020
YUGOSLAVIA	3130
ZAIRE	2040
ZAMBIA	2250

```
WHICH OPTION?RANK

WHICH VARIABLE?6
ALL COUNTRIES (YES OR NO)?N
HOW MANY?10
TOP OR BOTTOM?TOP

THIS WILL TAKE A MINUTE...PLEASE BE PATIENT.

CALORIE CONSUMPTION PER DAY PER CAPITA

U.S.A.          3300
FRANCE          3270
DENMARK         3250
AUSTRIA         3230
BELGIUM         3230
CANADA          3200
NETHERLANDS     3200
HUNGARY         3190
SWITZERLAND     3190
GERMANY         3180


WHICH OPTION?RANK

WHICH VARIABLE?6
ALL COUNTRIES (YES OR NO)?N
HOW MANY?10
TOP OR BOTTOM?B

THIS WILL TAKE A MINUTE...PLEASE BE PATIENT.

CALORIE CONSUMPTION PER DAY PER CAPITA

INDIA           1990
ETHIOPIA        1980
ECUADOR         1970
HAITI           1930
INDONESIA       1920
RWANDA          1900
ALGERIA         1890
EL SALVADOR     1850
BOLIVIA         1760
TANZANIA        1700
```

```
WHICH OPTION?HELP


THE 'EARTH' PROGRAM OFFERS 5 OPTIONS.  THEY ARE--

     TABLE:  THE COMPUTER WILL PRINT A TABLE SHOWING THE
VALUES OF UP TO 5 VARIABLES FOR UP TO 83 COUNTRIES.
FIND THE LIST OF VARIABLES AND THE LIST OF COUNTRIES IN
YOUR MANUAL (PP. 5  AND 6 ) OR USE THE 'LIST' OPTION.
THESE LISTS GIVE YOU THE CODE NUMBER YOU SHOULD ENTER
FOR EACH VARIABLE AND EACH COUNTRY.

     LIST:  THE COMPUTER WILL PRINT A LIST OF ALL VARIABLES
OR ALL COUNTRIES IN THE FILE.

     RANK:  THE COMPUTER WILL RANK THE VALUES FOR A GIVEN VARIABLE
AND PRINT THOSE VALUES IN RANK ORDER FROM HIGHEST TO LOWEST.
YOU CAN ASK FOR THESE VALUES FOR ALL COUNTRIES, OR YOU CAN
SPECIFY A NUMBER OF COUNTRIES FROM THE TOP OR BOTTOM OF THE LIST.
COUNTRIES FOR WHICH NO INFORMATION IS AVAILABLE WILL BE OMITTED.

     HELP:  THE COMPUTER WILL PRINT THIS LIST OF OPTIONS AGAIN.

     STOP:  TO END THE PROGRAM, TYPE 'STOP'.


WHICH OPTION?RANK

WHICH VARIABLE?1
ALL COUNTRIES (YES OR NO)?YES

THIS WILL TAKE A MINUTE...PLEASE BE PATIENT.

1971 POPULATION IN MILLIONS

CHINA                787.176
INDIA                550.374
U.S.S.R.             245.091
U.S.A.               207.05
INDONESIA            124.894
PAKISTAN             116.598
JAPAN                104.661
BRAZIL               95.468
GERMANY              75.129
NIGERIA              56.51
UN. KINGDOM          55.566
ITALY                54.078
FRANCE               51.25
MEXICO               50.83
```

KOREA	46.198
VIET NAM	40.404
PHILLIPINES	37.919
TURKEY	36.11
THAILAND	35.335
SPAIN	34.134
EGYPT	34.13
POLAND	32.749
IRAN	29.783
ETHIOPIA	25.248
ARGENTINA	23.552
ZAIRE	22.477
SO. AFRICA	22.092
COLOMBIA	21.772
CANADA	21.595
YUGOSLAVIA	20.55
ROMANIA	20.47
AFGHANISTAN	17.48
SUDAN	16.087
MOROCCO	15.238
ALGERIA	14.769
CZECHOSLOV.	14.5
PERU	14.015
TANZANIA	13.634
NETHERLANDS	13.194
SRI LANKA	12.762
AUSTRALIA	12.723
KENYA	11.694
NEPAL	11.29
HUNGARY	10.351
UGANDA	10.127
IRAQ	9.75
BELGIUM	9.673
PORTUGAL	9.037
CHILE	8.992
W. MALAYSIA	8.978
GHANA	8.858
GREECE	8.85
CUBA	8.657
BULGARIA	8.54
SA. ARABIA	7.965
SWEDEN	7.604
AUSTRIA	7.456
SY ARAB REP	6.451
SWITZERLAND	6.324
ECUADOR	6.297
YEMEN	5.9
S. RHODESIA	5.5
UPPER VOLTA	5.491
GUATEMALA	5.348
MALI	5.143
BOLIVIA	5.063
HAITI	4.969

```
DENMARK          4.963
FINLAND          4.684
IVORY COAST      4.48
ZAMBIA           4.275
DOM. REPUB.      4.182
NIGER            4.126
HONG KONG        4.045
SENEGAL          4.022
GUINEA           4.01
NORWAY           3.903
RWANDA           3.827
CHAD             3.8
EL SALVADOR      3.647
BURUNDI          3.615
LAOS             3.033
ISRAEL           3.013


WHICH OPTION?STOP

DONE
```

EXERCISES

1. To determine what factors are associated with high energy use, do the following.

   a. Using the RANK option, identify the twelve highest and the twelve lowest energy-using countries (that is, highest and lowest for variable 12: 1971 energy consumption).

   b. Then use the TABLE option and ask for data on variable 1 (1971 population) and variable 8 (1971 national income) for these 24 countries.

   c. Using the data you just obtained, can you determine "1971 income per capita"? Here is a short program you can load and run to do the calculations.*

```
CAPITA

50  PRINT "1971 INCOME PER CAPITA"
100  PRINT "ENTER POPULATION IN MILLIONS, THEN NAT'L. INCOME"
130  PRINT "IN MILLIONS OF DOLLARS (0,0 TO STOP)"
150  INPUT P,I
200  IF P=0 THEN 400
250  PRINT "$";I/P
300  GOTO 150
400  END
```

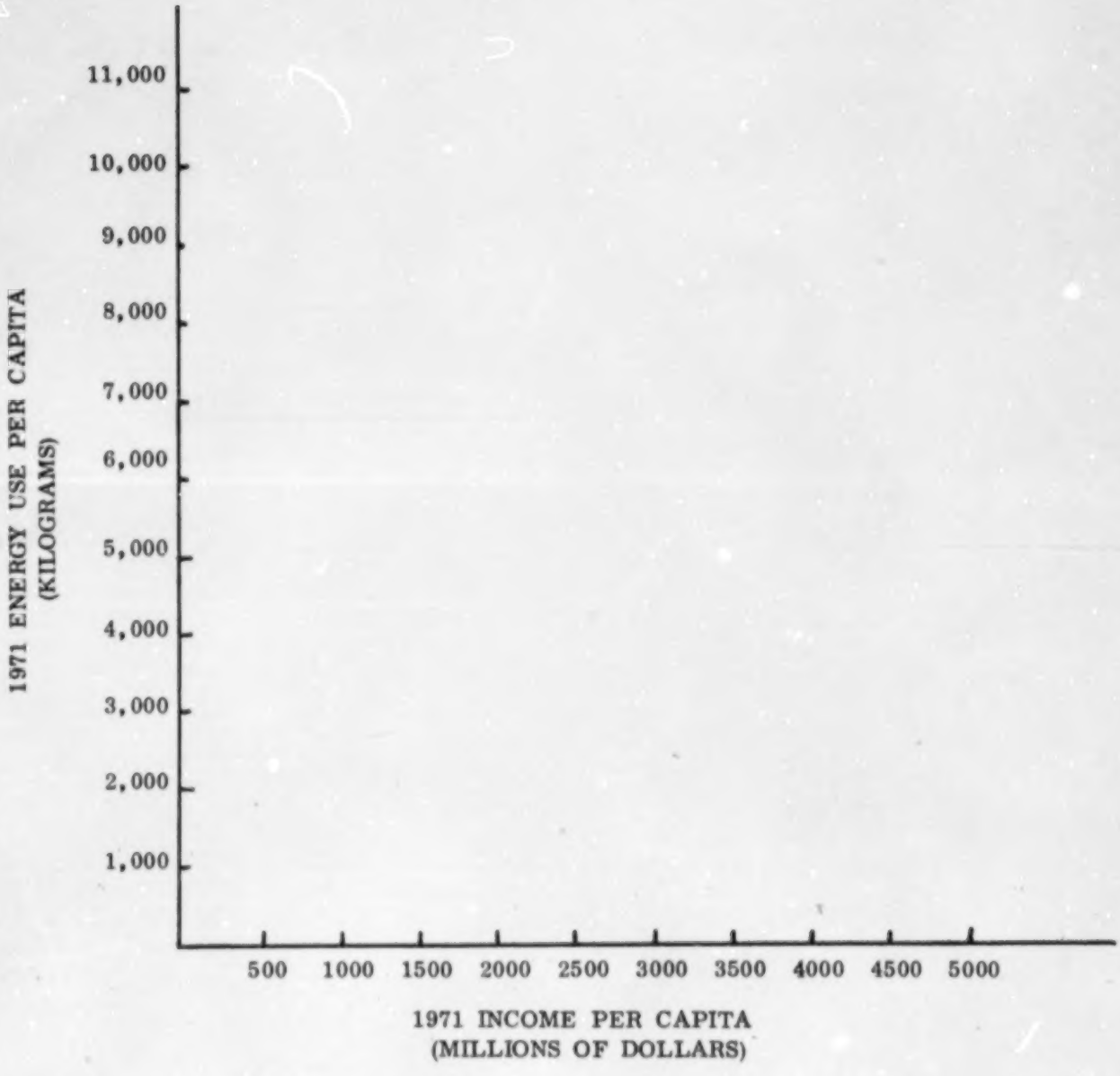
   d. On the table for the 24 countries, add a column for "1971 income per capita," and enter the values you calculated using the CAPITA program. Does there seem to be a relatfonship between national income per capita and energy use?

2. Use the TABLE on the RANK option to obtain data on 1971 energy consumption per capita (variable 14) for the 24 countries.

   You now have calculated data for 1971 income per capita and 1971 energy use per capita. To gain a clearer picture of the relationship, plot the data for each country on the "scatter diagram" on the next page.

---

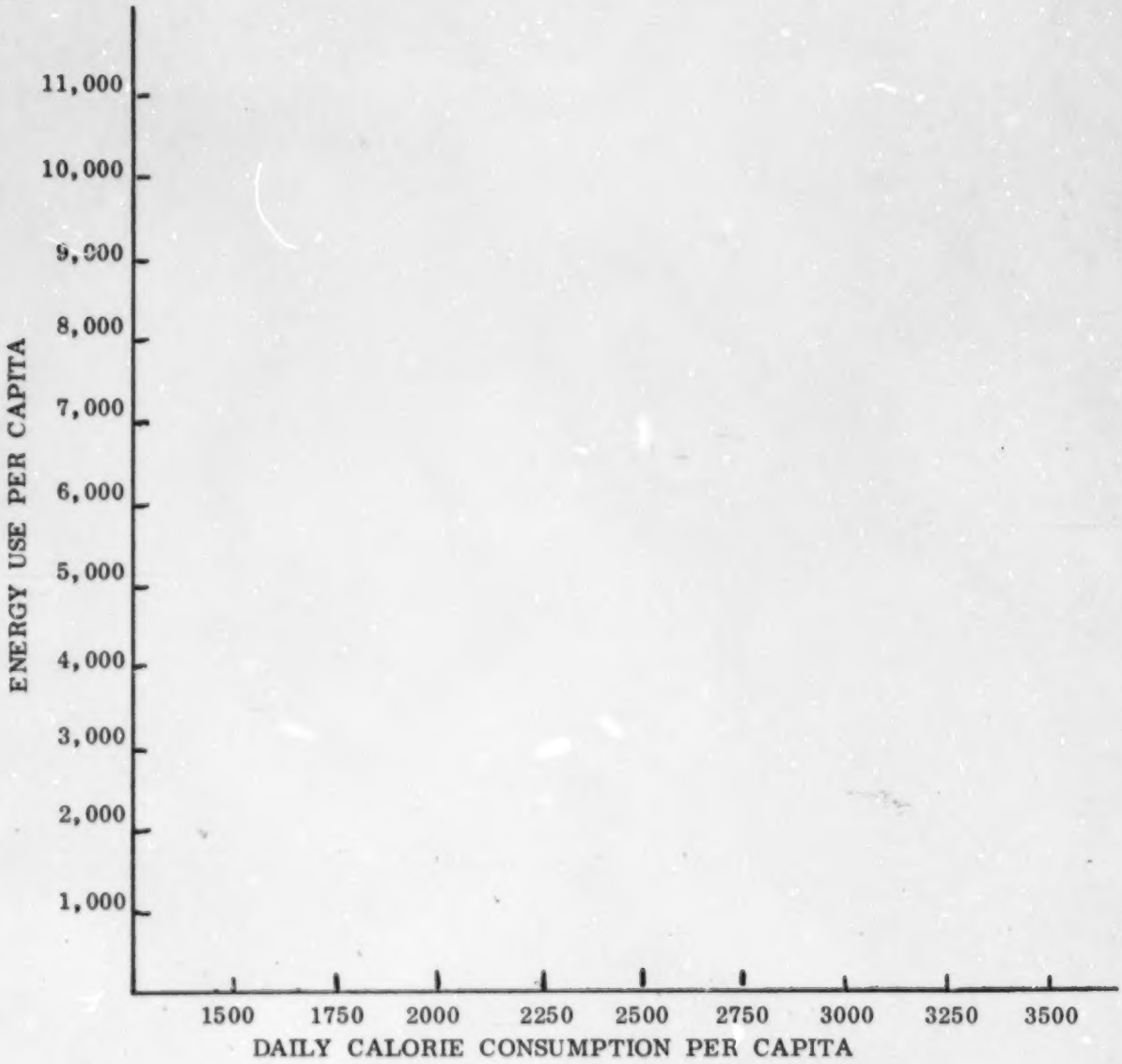
* If there are any zeros in your table, do not enter data for that country in the CAPITA program. Zeros stand for "Data Unobtainable."



Is there a relationship? What is it? What are the implications of such a relationship?

3. Using the TABLE option, obtain the daily calorie consumption per capita (variable 6) and energy consumption per capita (variable 14) for twelve high energy-using countries.

   Plot this data on the scatter diagram on the following page.



If food consumption can be taken as an indicator of "quality of life," how does energy use seem to be related to quality of life?

4. a. How are demands for energy increasing? To find out, use the TABLE option to obtain data on variables 11 and 12 (1968 and 1971 energy consumption) for all countries. From this table select ten countries whose demands appear to be increasing significantly.

Compute the "increase rates" for these 10 countries, using the program below:*

```
INCRS

50  PRINT "INCREASE RATES FOR ENERGY DEMANDS"
100  PRINT "INPUT VALUES FOR 1968, THEN 1971 (0,0 TO STOP)"
150  INPUT A,B
200  IF A=0 THEN 400
250  PRINT ((B-A)/A)*100;"%"
300  GOTO 150
400  END
```

Enter these increase rates in another column on the table you obtained above.

Which nations are requiring higher proportions of energy?

b. Is the energy produced by these countries increasing as rapidly as the energy consumed? To find out, repeat all of this exercise for variables 9 and 10 (1968 and 1971 energy produced) and compute the increase rates for energy production.

Compare increase rates for energy consumption and energy production for each of the ten countries. What are the trends?

5. Using the RANK option, determine where the world's energy reserves are located: for all countries, rank order variables 15, 17, 19 and 21 (reserves of coal, lignite, petroleum and natural gas).

Plot these reserves on a world map.

Which parts of the world have greater energy reserves? Fewer? What are the economic and political implications of this distribution?

Exploring Further

Make up your own questions and hypotheses regarding world energy use and production. Test the hypotheses using the EARTH program. (Example: Is population "density" related to energy use? How?)

Are there other variables and/or other countries you would like to add to the data base? If so, discuss this with your teacher.

* Again, omit any countries which have zeros in the table.

SOURCES OF INFORMATION ON THE ENERGY CRISIS

Books

Energy and Power. W. H. Freeman. San Francisco: Scientific American Books, 1971. (Eleven easy-to-read articles about energy today.)

Energy: Demand Vs Supply. Diana L. Reische, Ed. New York: The H.W. Wilson Company, 1975.

Energy: The Continuing Crisis. Norman Metzger. New York: Thomas Y. Crowell Company, 1976.

Energy for Survival. Wilson Clark. Garden City, New York: Anchor Books, 1974. (An analysis of alternate energy sources whose development might provide a partial solution to our energy problems.)

Energy Crisis--Volume 1, 1969-73. Lester A. Sobel, Ed. New York: Facts on File, Inc., 1974. (This book traces the development and events of the energy crisis through a series of news articles written as weekly coverage of news events.)

A Time to Choose--America's Energy Future. Final Report of the Energy Policy Project of the Ford Foundation. Cambridge, Massachusetts: Ballinger Publishing, 1974. (An examination of the future shape of the energy shortage, this report is very well documented with up to date data.)

Newspapers

Each day, newspapers carry new stories about the energy crisis, including local and national problems and plans.

Periodicals and Reference Works--Subject Headings

A wealth of information on the energy crisis is contained in periodicals and standard reference works like encyclopedias. Subject headings which you can use to locate information through card catalogs, Encyclopedia Yearbook Indexes, and other standard indexes are:

Atomic energy
Atomic power
Atomic research
Automobiles

Coal mines and mining
Coal research
Conservation of energy
Conservation of natural resources

Diesel engines

Economics
Electric power
Electric utilities
Electricity
Energy crisis
Energy crisis--U.S. Foreign Policy
Energy crisis--sources

Fuel
Fuel research
Fuel supply

Gas, natural
Gas, industry
Gas manufacture and works
Gasoline
Geothermal energy

Hydroelectric plants
Hydrogen, liquid

Industry and state
Industry and the environmental movement
Insulation
International Atomic Energy Agency

Nuclear fuels
Nuclear fusion
Nuclear reactors

Petroleum
Petroleum industry
Petroleum refineries
Petroleum supply
Power resources

Solar energy
Solar furnaces (heating)
Strip mining

United States Energy Agency
United States Federal Power Commission

Wind power